
D. PROJECT REVIEWS PANEL SESSION

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2. *William P. Dillon and Timothy S. Collett, U.S. Geological Survey*
3. *J. Robert Woolsey, The Center for Marine Resources and Environmental Technology, University of Mississippi*
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5. *Joseph F. Gettrust, U.S. Naval Research Laboratory*
6. *Andrew Shephard, National Undersea Research Center*
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Methane Hydrates Research at DOE National Laboratories

Resource Characterization

Production

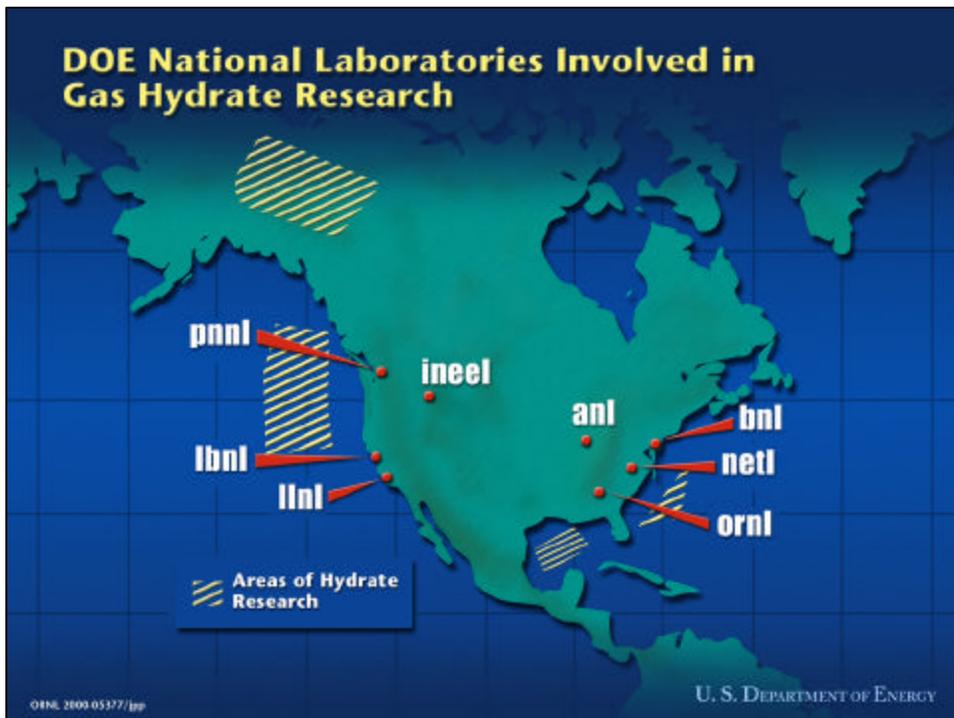
Global Carbon Cycle

Safety & Seafloor Stability

Developed for
The DOE Methane Hydrates Working Group Committee

Presented by
Lorie Langley
Committee Chair

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Ongoing Hydrate Research

Understand factors governing hydrate thermodynamic stability:

- Techniques have been developed to grow large crystals at -5°C for neutron studies
- X-ray study of field samples

Proposed Hydrate Research

Kinetic study with PFTs to track methane production

Study localized hydrate decomposition stimulated by sonolysis mimicking direct subsurface conditions

Kinetic modeling using molecular simulation methods including the Methods of Moments (MOM)

BNL Capabilities for Hydrate Research

- A dedicated bench-scale unit (P: to 12 MPa; T: -20 to +150°C; V ~ 1.5 L) operable in both static and dynamic modes
- Crystal growth and neutron studies of clathrate hydrates
- Kinetics & kinetic modeling
- Perfluorocarbon Tracer (PFT) technology, methane transport

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Ongoing Hydrate Research

- Measure microbial location and activity on samples from Canada and Japan

Proposed Hydrate Research

Fundamental physical properties and chemical stability of gas hydrates in nature and during hydrocarbon exploration and production

- Evaluate and demonstrate thermodynamic constraints on CH₄ formation
- Transport
- Geophysics
- Economics

INEEL Capabilities for Hydrate Research

- Microbiological studies
- Geophysical studies
- Reservoir seismic interpretation
- Transport model development
- Feasibility evaluation for a large-scale hydrates test center

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Ongoing Hydrate Research

- Reservoir Simulation that include multiphase, multicomponent, thermal simulation for developing production technologies
- Geophysics for high resolution seismic and mid frequency electromagnetic imaging
- Rock Properties in the 100kHz frequency range to measure flow and geotechnical stability

Proposed Hydrate Research

Assessment of impacts on geological environment for hydrate recoverability

- Reservoir simulation of geologic/geophysics

Laboratory Studies

- Hydrate stability properties
- Hysteresis and solubility
- Bulk seismic properties

Code Extension and Validation to incorporate thermodynamic properties and biochemical process

LBL Capabilities for Hydrate Research

Formation Mechanisms, Structure and Stoichiometry
 Isotope Geochemistry
 Microbial Studies
 Seismic Geophysics
 Reservoir Simulation

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Ongoing Hydrate Research

- Physical and kinetic properties of gas hydrates
- Deformation testing, thermal properties, elastic properties
- Kinetic Behavior
- Dissociation of pure methane hydrates inside and outside stability field for T&P
- Gas exchange of CO₂ - CH₄ hydrates

Proposed Hydrate Research

Fundamental physical properties and chemical stability of gas hydrates in nature and during recovery

- Mechanical disturbance to hydrate bearing sediments
 - ▶ Factors affecting hydrate content & composition during core drilling
 - ▶ Stability of hydrate formation during production
 - ▶ Resource assessment tools for the Gulf of Mexico
- Hydrate formation as a diagenetic process in marine sediments

LLNL Capabilities for Hydrate Research

- Geophysics and Geochemistry Studies
- Predictive Models
- Economic Validation
- Basic Research of seafloor safety and stability

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Ongoing Hydrate Research

- Hydrate formation in the Seafloor Process Simulator (SPS)
- Completed data fusion and computational tool development for geophysical properties
- Molecular modeling activity continue for prediction of phase stability in hydrate systems
- Completed seismic evaluation at Mallik

Proposed Hydrate Research

- High-Resolution, Three-Dimensional Seismic Reflection Imaging
- Information Fusion for Hydrate Resource Assessment
- Crystallography Evaluations by Neutron Diffraction of Methane Hydrates on Polycrystalline Structures
- Collaborations for Enhanced Methane Hydrate Systems Analysis using the SPS
- Environmental Benefits and Impacts of Methane Hydrate Production

ORNL Capabilities for Hydrate Research

- Seafloor Process Simulator Facility for scale-up experiments
- High Flux Isotope Reactor (HFIR) for neutron diffraction activity
- Computational Resources for hydrate assessment and understanding geophysical properties

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Ongoing Hydrate Research

Isotope Separations
Organic Separation and Immobilization
CO₂ Sequestration

Proposed Hydrate Research

Methane Recovery from methane hydrates

- Advanced method that manipulate PT-Thermodynamics without energy input
- Applied engineering methods to enhance heat transfer to reservoir
- Improved mining strategies

CO₂ Sequestration

- Develop molecular-level models to understand hydrate-sediment/soil interactions
- Enhancing Ocean Sequestration using Inorganic supports

PNNL Capabilities for Hydrate Research

Mid to Large-scale Testing Capabilities
Field Data from deep sea ecology (marine lab in Sequim, WA)
Field Testing of CO₂ sequestration concepts with NRL

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